

CA Estuaries Portal & State of the Estuary Report 2015

California Estuary Monitoring Workgroup

**Hildie Spautz, Senior Environmental Scientist (Specialist, California
Dept. Fish & Wildlife - Ecosystem Restoration Program, Performance
Measures Unit.**

February 23, 2015

Presentation Outline



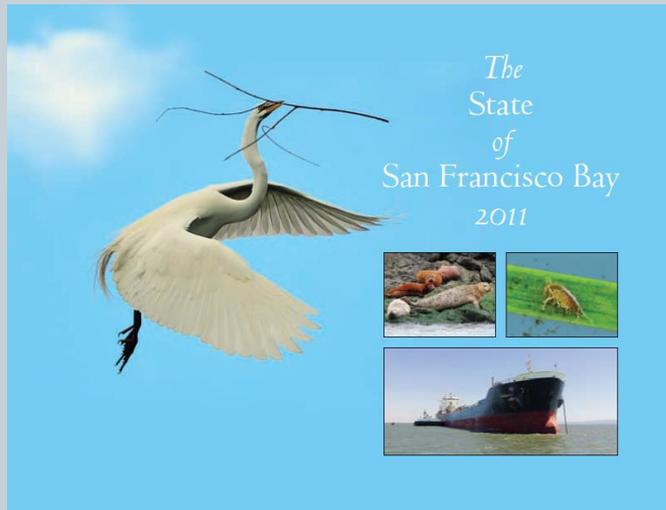
- 1 **State of the Estuary Report 2015 (SOTER) Background**
- 2 **Summary of indicators: SF Bay and new for Delta/Suisun**
- 3 **Details: New Delta & Suisun indicators with links to Estuaries Portal**
 - Fish** – Suisun, Fall Mid-Water Trawl, Juvenile Fish Beach Seine. Alison Weber-Stover & Jonathan Rosenfield, TBI, Contracted by SFEP.
 - Food web – Zooplankton.** April Hennessy, CDFW / IEP
 - Food web – Benthic invertebrates.** Betsy Wells, DWR-EMP / IEP.
- 4 **Next Steps**
- 5 **Discussion**

Introduction: Purpose of SotER 2015



- Present a science-based assessment of the health of San Francisco Bay-Delta ecosystem.
- Educate the public and help scientists and managers make decisions about how to best allocate resources to protect and restore the Bay-Delta ecosystem.
- Parallels to the CA Estuaries Portal: Integrate the data and information gained from Estuary monitoring activities into a coherent ecosystem health assessment.

State of the San Francisco Bay Report 2011



The State of San Francisco Bay 2011 Technical Appendices

Available: <http://www.sfestuary.org/about-the-estuary/sotb/>

Indicator Summary from State of the San Francisco Bay Report 2011 (handout)

SUMMARY OF BAY HEALTH, 2011			
	STATUS	TREND	DETAILS
WATER			
Safe for aquatic life	Fair	Improving	Bay water quality is better than 40 years ago, but the rate of improvement has slowed. Mercury, exotic species, toxic sediments, and trash are still problems, with improvement expected for exotics and trash. Many potentially harmful chemicals have yet to be assessed.
Fish safe to eat	Fair	No change	Limited consumption of most popular Bay fish species is advised due to contamination from legacy pollutants. No signs of improvement since 1994.
Safe for swimming	Good	No change	Most Bay beaches are safe for swimming in summer, but bacterial contamination is still a problem at most beaches in wet weather.
Freshwater inflow	Poor	No change	Amounts and variability of freshwater inflows have been reduced, resulting in chronic drought conditions for the Estuary. Flow conditions have been predominantly poor for the last 10 years, with the Freshwater Inflow Index at a record low level in 2010.
HABITAT			
Estuarine open water	Fair to poor	Deteriorating	Quantity and quality of springtime habitat is declining. Since the 1980s, habitat conditions have generally been poor in all but wet years.
Baylands	Fair	Improving	Historic decline has ended; gradual restoration underway; there is a long way to go.
Watersheds	Fair	No change	Watersheds are largely stabilizing after damage from historical land use changes; monitoring in more watersheds is needed to improve assessment of status.
LIVING RESOURCES			
Fish	Mixed, mostly fair	Deteriorating	Fish abundance and diversity are declining in all regions of the Bay except near the Golden Gate. The fish community is in poor condition in Suisun Bay.
Shrimp/Crab	Good	Improving	Most shrimp and crab populations are increasing, but ocean species dominate in the Bay. The abundance of Dungeness crab juveniles fluctuates widely, but Bay shrimp are generally stable.
Birds	Mixed, mostly fair	Trends mixed	Some populations are increasing, some are static, and some are declining, with some earlier increases recently reversed. Tidal marsh birds are below desired levels. Reproductive success is generally low or has decreased since 1993.
ECOLOGICAL PROCESSES			
Flood events	Poor	Deteriorating	Dams and water diversions have cut frequency and duration of floods by more than half, reducing freshwater inflow variability and transport of sediment and nutrients to the Bay.
Food web	Fair	Deteriorating	Declines in reproduction of fish-eating birds suggest that less food is available.
STEWARDSHIP			
Individual/Community action	Fair	Improving	Active stewardship could be greater, but regional efforts appear to be increasing. Bay Area citizens are using water more efficiently, and we are gradually expanding our use of recycled water.
Management action (example)	Good	Improving	In-Bay disposal of dredged material has been greatly reduced since the Comprehensive Conservation and Management for the Estuary was adopted in 1993.

SOTER 2015 Format



- Printed report as in 2011
 - ❖ Printable executive summary and 1-page health summary. Editors Letitia Grenier & Ariel Rubissow.
- Online content
 - ❖ Report Card on San Francisco Estuary Partnership's website (<http://www.sfestuary.org/>)
 - ❖ Interactive Content - *to be decided* – SFEP contract with SFEI
 - ❖ Links to CA Estuaries Portal, other CWQMC portals and/or other websites for background information & data – *to be decided*

Related Efforts for Coordination/Integration



- CA Estuaries Portal
- CA Wetlands Portal
- Other CWQMC Portals
- State of the Bay-Delta Science
- Pulse of the Bay

State of the Estuary Report 2015 – Proposed Indicators (handout)

No.	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
	WATER				
1a	Quality: Safe for aquatic life	Jay Davis, SFEI, and Stephanie Fong, SFWCA	Methylmercury in prey fish Sediment toxicity Copper in water DO in water Silver in water Water toxicity Other priority pollutants Ammonium	Sediment toxicity Water toxicity	Estuaries Portal
			Narrative sidebar only: Other Priority Pollutants Exotic species Trash Selenium PAHs, PBDEs, PFOS, Fipronil, Nonylphenol, Other CECs Nutrients Current Use Pesticides	Narrative sidebar only: Other Priority Pollutants Exotic species Trash Selenium PAHs, PBDEs, PFOS, Fipronil, Nonylphenol, Other CECs Nutrients Current Use Pesticides	Estuaries Portal

No.	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
1b	Quality: Fish safe to eat	Jay Davis, SFEI, and Stephanie Fong, SFWCA	Narrative sidebar only: CEC's	Methylmercury PCBs Dioxins, Dieldrin, DDTs, Chlordanes, Selenium, PBDEs. Narrative sidebar only: CEC's	Safe to Eat
1c	Quality: Safe for swimming	Jay Davis, SFEI, and Stephanie Fong, SFWCA	Fecal bacteria concentrations at beaches (2011-2014)	Limited data availability, no indicator planned	Safe to Swim
1d	Quality: Safe to drink	Jay Davis, SFEI, and Stephanie Fong, SFWCA	No indicator planned.	Narrative sidebar only: Pathogens, THMs	Safe to Drink

No.	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
2	Quantity: Freshwater inflow	Tina Swanson, NRDC (Bay & Delta)	Magnitude, duration, and frequency of freshwater inflow from Delta into Bay.	Relative to unimpaired flow: Delta inflow Delta outflow (Inflow to Bay) Delta diversions % Delta inflow from San Joaquin River Spring inflow to Delta Interannual variation in inflow Seasonal variation in inflow to Bay	Estuaries Portal/ Water Quality Conditions Report (D1641)
	HABITAT				
3	Estuarine open water	Tina Swanson, NRDC	Quantity and quality of seasonal low-salinity habitat (X2)	See to left; and Reverse Flows indicator.	Estuaries Portal
4	Baylands (tidal marsh, tidal flat, and others)	Robin Grossinger, SFEI (Bay) Kristal Davis-Fadke, Delta Conservancy (Delta)	Tidal marsh & tidal flat habitat: Regional extent, Patch size Physical/biological condition (CRAM) (Benchmarks for extent and patch size from Baylands Habitat Goals)	Tidal Marsh & Riparian habitat: Regional extent, Patch size. (Data from SFEI's Delta Landscapes Project)	Wetlands Portal, Estuaries Portal
5	Watersheds	Josh Collins, SFEI, Caitlin Sweeney, SFEP	Data from EPA's 2013 "California Integrated Assessment of Watershed Health" will be used to calculate indicators. Three tributaries in the Bay will be included.	See to left. Three tributaries to the Delta will be included.	Streams Rivers & Lakes Portal

No.	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
LIVING RESOURCES					
6	Invertebrates	Tina Swanson (Bay) April Hennessy & Betsy Wells (Delta)	Shrimp & crab abundance, distribution and species composition	San Pablo, Suisun & Delta Food web: * EMP Zooplankton study: Copepod and Mysid biomass. * EMP Benthic Study (DWR): Bivalve, worm and arthropod density; all species diversity.	Estuaries Portal
7	Fish	Tina Swanson (Bay) Ali Weber-Stover & Jon Rosenfield, TBI (Delta & Suisun Marsh)	Bay Fish (CDFW Bay Study data): Abundance, diversity, species composition, and distribution.	Delta & Suisun Marsh Fish: * Suisun Marsh Fish data (Suisun Marsh, Peter Moyle UC Davis) * Fall Midwater Trawl (Suisun Bay and Central-West Delta) * USFWS Juvenile Fish program - Seines (North, East, South & Central West)	Estuaries Portal
8	Birds	Nadav Nur, Pt. Blue (Bay) Hildie Spautz, CDFW (Delta & Suisun Marsh)	Tidal marsh birds Heron/egret nest density Heron/egret nesting success Winter waterfowl abundance. Shorebird (winter) Ridgeway's (Clapper) Rail.	Breeding waterfowl abundance (Suisun Marsh & Delta). Narrative sidebars only: Sandhill crane California black rail	Estuaries Portal
9	Mammals	Nadav Nur (Bay)	Harbor seal abundance	No indicator planned.	Estuaries Portal

No.	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
ECOLOGICAL PROCESSES					
10	Flood events	Tina Swanson, NRDC (Bay & Delta)	Frequency & magnitude of high freshwater inflow events	Frequency & magnitude of high freshwater inflow events relative to unimpaired flow	Estuaries Portal
11	Food web	Nadav Nur (Bay)	Heron/egret brood size Brandt's Cormorant reproductive success.	See zooplankton & benthic indicators above. Narrative sidebar only: how nutrients and chlorophyll a relate to the food web (see indicator #13 below).	Estuaries Portal
STEWARDSHIP					
12	Individual, community and management actions	Judy Kelly, Peter Vorster (Bay)	urban water use recycled water use coastal cleanup public access	coastal cleanup	

No	Indicator	Leads	Bay	Delta	Potential Link to CWQMC Portals
NEW FOR THE BAY & ESTUARY IN 2015					
13	WATER QUALITY AND ECOLOGICAL PROCESSES (Food Web): Nutrients/ Chlorophyll-a	Jay Davis, SFEI (Bay & Delta)	Narrative sidebar only: Chlorophyll a and nutrients in Bay & Delta.	see to left	Estuaries Portal
14	HABITAT: Subtidal	Caitlin Sweeney and Marilyn Latta (Bay)	Regional extent of native eelgrass. Regional extent of oyster beds. (Benchmarks from the Subtidal Goals report)		Wetlands Portal
15	ECOLOGICAL PROCESSES: Sediment Supply	TBD	Possible narrative sidebar only	See to left.	Estuaries Portal
16	ECOLOGICAL PROCESSES: Climate Change	Luisa Valiela, EPA, Josh Collins, SFEI (Bay & Delta)	Availability of undeveloped sea level rise accommodation space in the Bay & Delta.	See to left.	Wetlands Portal
17	HABITAT: Gulf of the Farallones	Andy Gunther	Gulf of Farallones: Dissolved oxygen indicator that relates to climate change and habitat	N/A	
18	HABITAT: Invasive Aquatic Vegetation	Shruti Khanna & Susan Ustin, UC Davis (Delta)	N/A	Narrative sidebar only: Distribution of FAV/SAV using remote sensing data	Estuaries Portal

Process to Develop New Indicators



- Indicator selection
 - ✦ Identify appropriate dataset & metrics:
 - E.g., Abundance, density, species diversity, species composition, percent native vs nonnative
 - ✦ Identify appropriate ways to summarize data:
 - Species groupings
 - Spatial groupings (Estuary-wide vs. sub-regional)
 - Temporal groupings (seasonal or annual)
- Establish reference conditions
- Score threshold designation/evaluation

New Indicators – Summary of Methods

	Fish	Zooplankton	Benthic invertebrates
Monitoring Data	Suisun Marsh (UCD) Fall Midwater Trawl (CDFW) Delta Beach Seine (USFWS)	EMP Zooplankton Study (CDFW/DWR) Copepod and Mysid data	EMP Benthic Study (DWR) Bivalve, worm and arthropod data (density); all species data (diversity)
Metric	Abundance = catch/effort % Native fish = $[(\# \text{ native fish}) / (\# \text{ total fish})] * 100$ % Native species = $[\# \text{ native species} / (\# \text{ total species})] * 100$	Annual mean biomass (milligrams of Carbon/m ³)	Annual mean density (individuals/m ²) Annual diversity (% of all native species) Annual community composition (% native individuals or species)
Reference period for benchmark	1980-1989 for Suisun Marsh and FMWT 1995-2005 for Delta Beach Seine	1974-1986 for Suisun and Delta 1998-2002 for San Pablo Bay	1981-85 for Suisun Bay and Delta 1993-97 for San Pablo Bay
Regions	Suisun Marsh, Fall Midwater Trawl (Suisun Bay and Central-West Delta), and Juvenile Fish Seines (North, East, South and Central West); see map	San Pablo, Suisun, Delta	

Indicator Scoring

Indicator	Quantitative reference condition	Evaluation & Interpretation	Score
Fish - Abundance (individuals/unit effort or trawl)	>150% of historical reference period average	“Excellent”	4
	>100% of historical reference period average	“Good”	3
Benthic Invertebrate - Density (individuals/m ³)	>50% of historical reference period average	“Fair”	2
	>15% of historical reference period average	“Poor”	1
Zooplankton – Biomass	≤ 15% of historical reference period average	“Very Poor”	0
Native diversity	>60% of all possible native species	“Excellent”	4
	>50% of all possible native species	“Good”	3
	>40% of all possible native species	“Fair”	2
	>30% of all possible native species	“Poor”	1
	≤ 30% of all possible native species	“Very Poor”	0
Community composition (species or individuals)	>95% native	“Excellent”	4
	>85% native	“Good”	3
	>70% native	“Fair”	2
	>50% native	“Poor”	1
	≤ 50% native	“Very Poor”	0

New Delta & Suisun **Fish** Indicators



Authors:

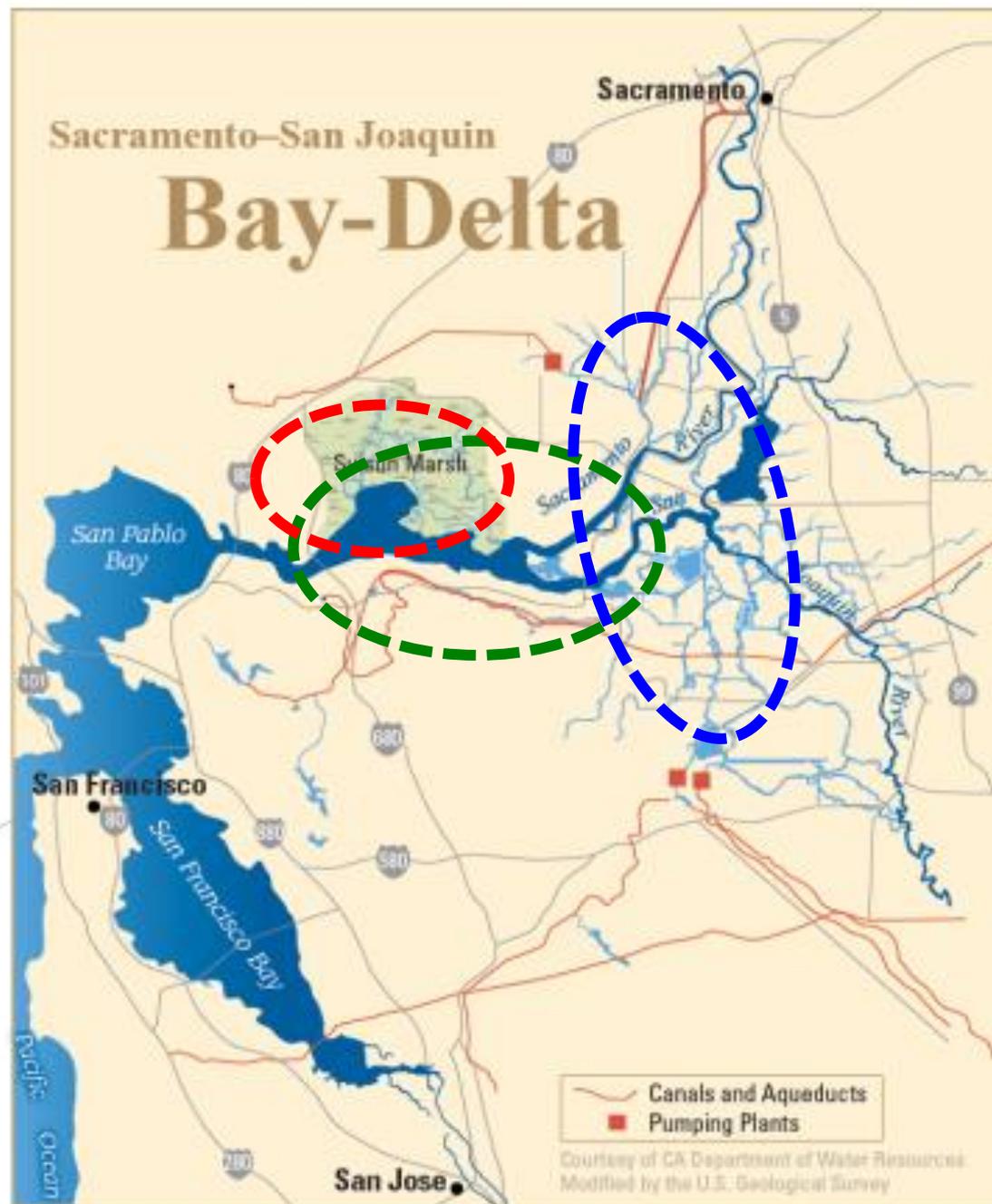
Alison Weber-Stover & Jonathan Rosenfield, The Bay Institute

Peer input:

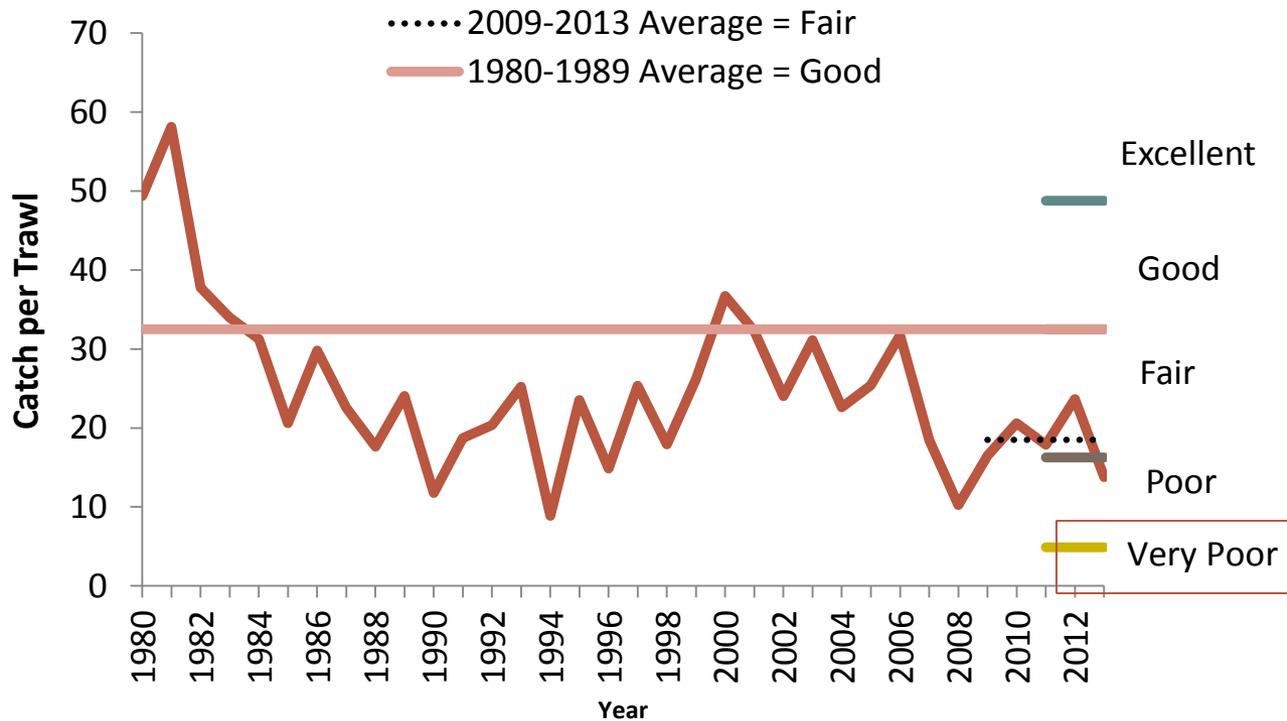
Tina Swanson (NRDC), Kris Jones (DWR), Randy Baxter (CDFW), Sam Harader (DSP), Ted Sommer (DWR), Matt Dekar (USFWS), T. O'Rear (UCD), Susie Tharatt (USFWS), Daniel Huang (DSC), Hildie Spautz (CDFW), J. Kirsch (USFWS)

Delta & Suisun Fish Indicator: Fish Sampling Programs

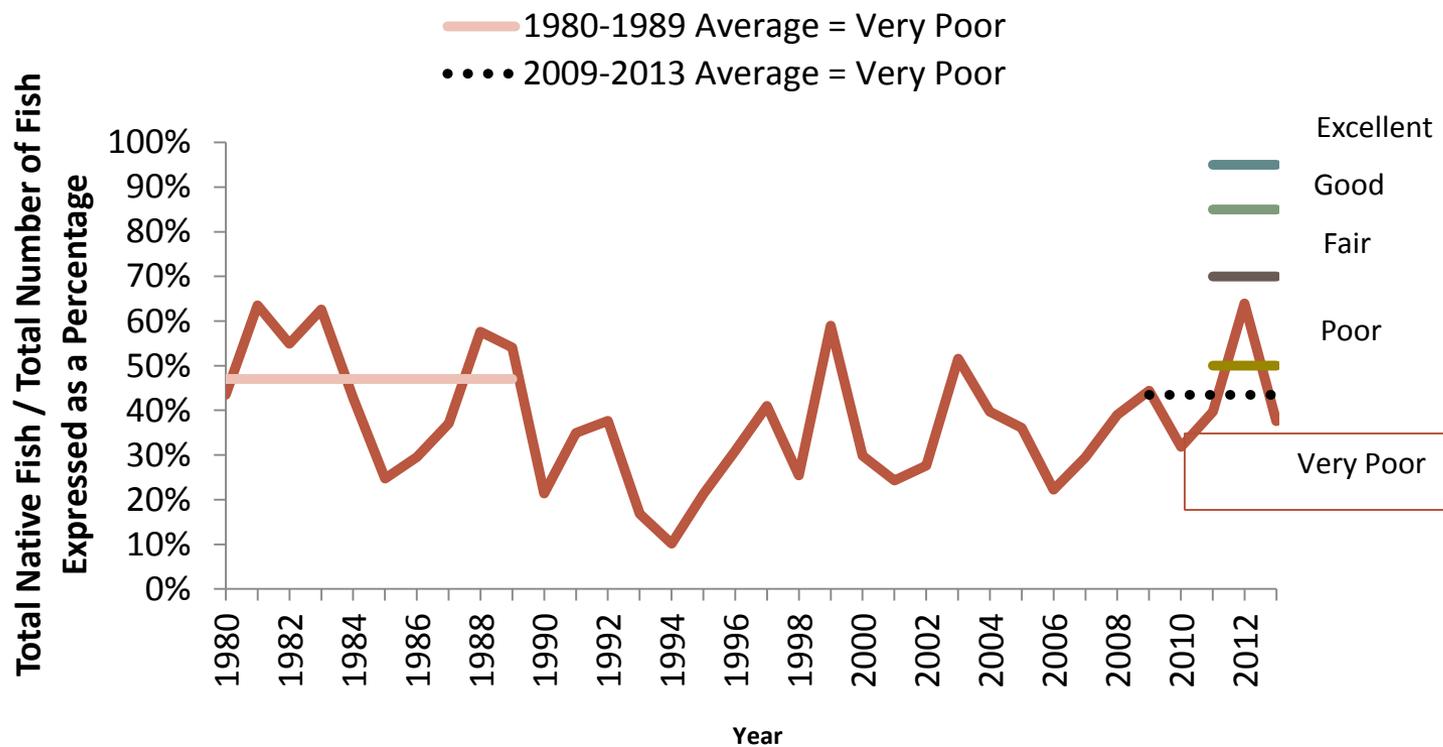
- Fall Midwater Trawl (CDFW)
- Suisun Marsh (UCD)
- Delta Beach Seine (USFWS) 1995-2013



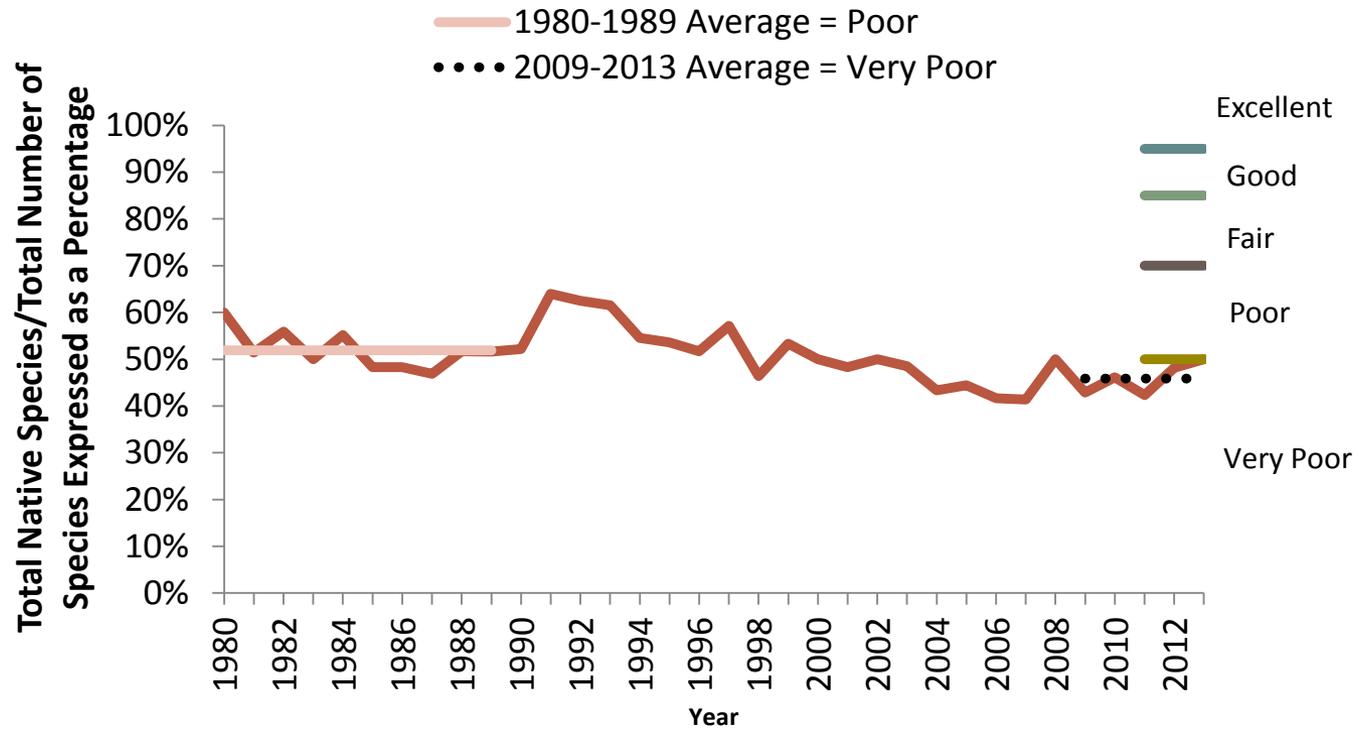
Fish Abundance Indicators Suisun Marsh



Percent *Native Fish* Individuals Suisun Marsh



Percent *Native Fish Species* Suisun Marsh



Summary of Suisun Marsh Fish Indicators



- Average abundance in Suisun Marsh declined from “good” to fair.
- Percentage of native fish remained “very poor”.
- Percentage of native species declined from “poor” to “very poor”.

Delta Food Web: Zooplankton



Author:

April Hennessy, CDFW

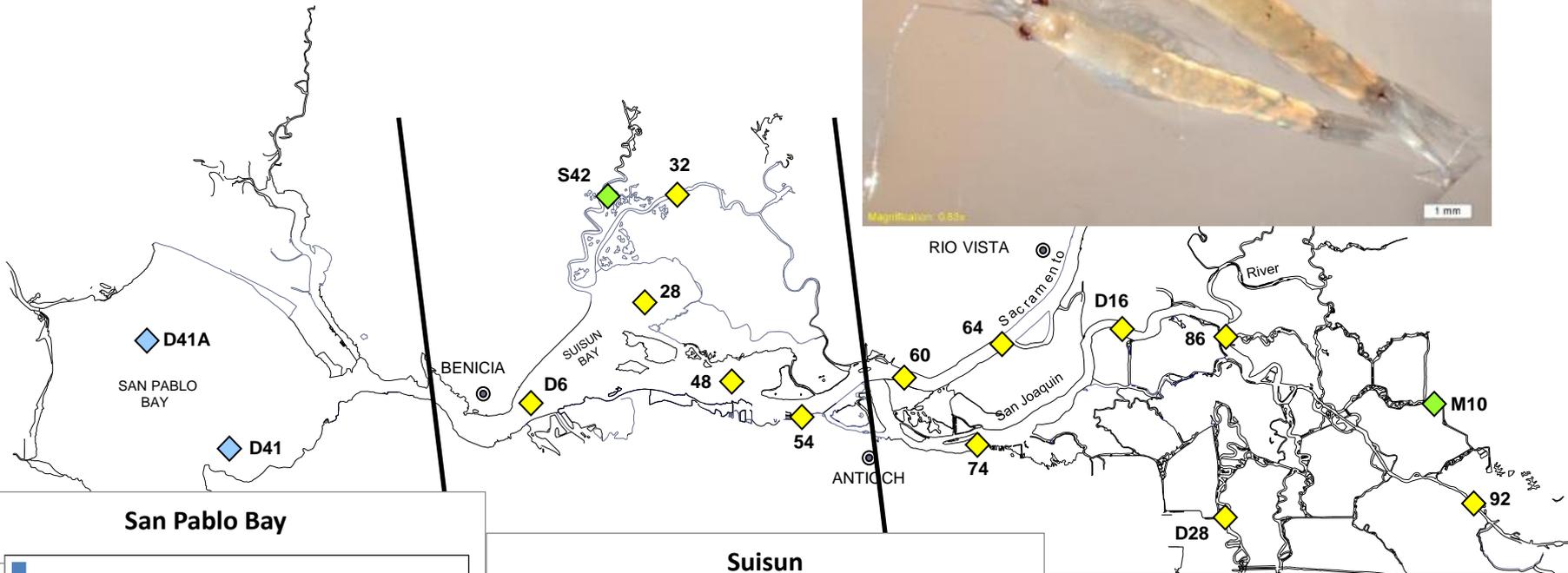
Peer input - forthcoming. Proposed participants:

Kathy Hieb (CDFW), Tina Swanson (NRDC), Betsy Wells (DWR),
Wim Kimmerer (SFSU).

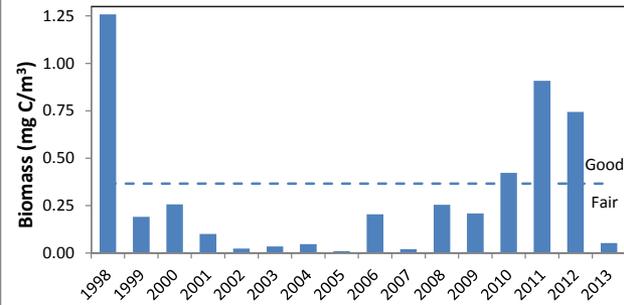
Why Zooplankton is an important Estuary Food Web Indicator:

Zooplankton are important food sources for larval and juvenile Chinook salmon, striped bass and splittail, and small fish including Delta smelt in the SF Estuary. Species composition varies between salinity zones, resulting in different zooplankton communities in freshwater, brackish, and salty environments.

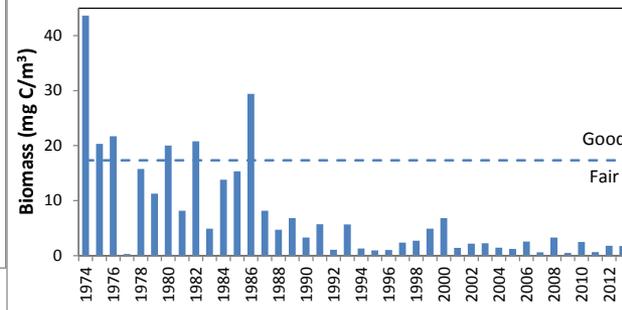
Mysid biomass



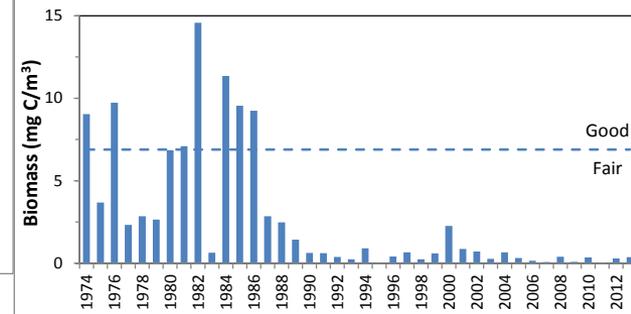
San Pablo Bay



Suisun

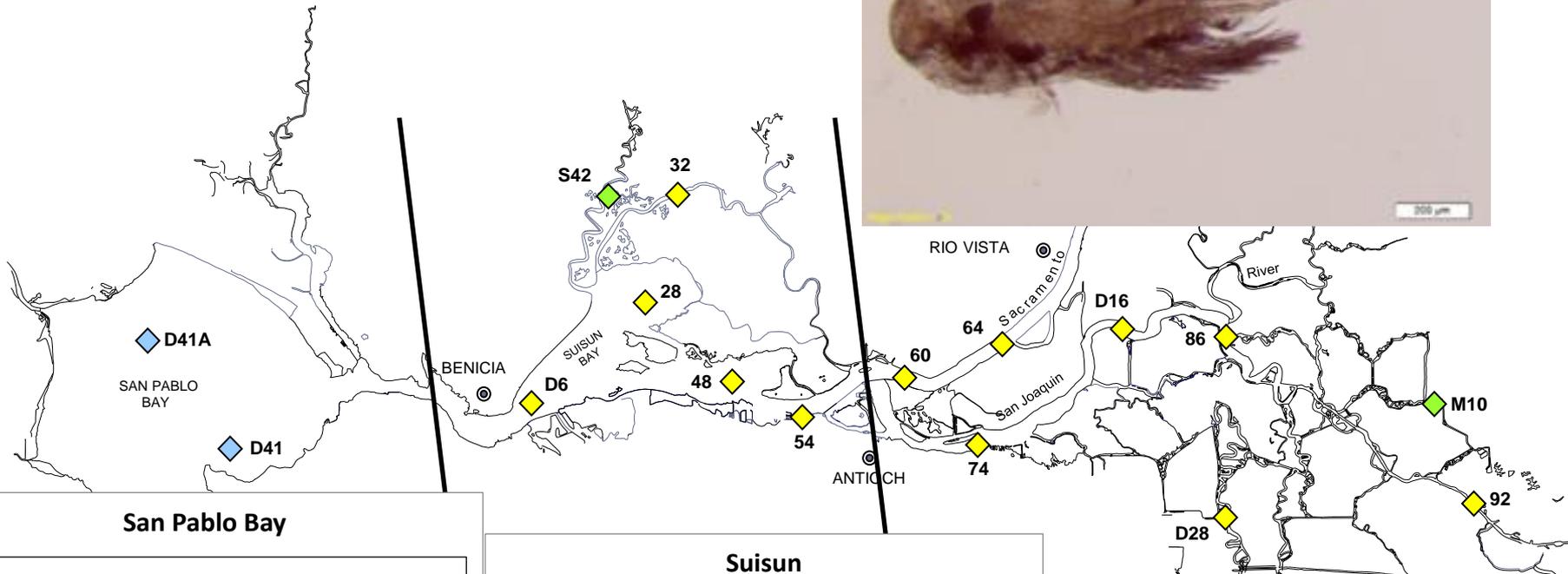


Delta

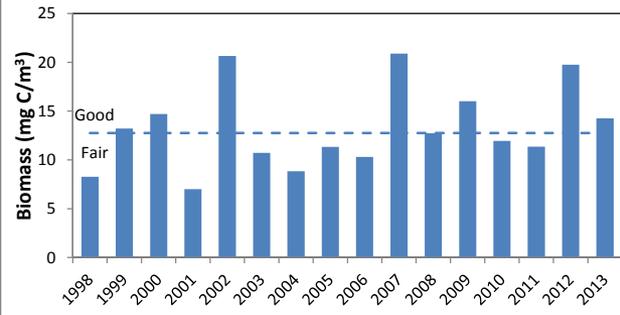


Benchmark – San Pablo Bay: ave. 1998-2002; Suisun & Delta: ave. 1974-1986

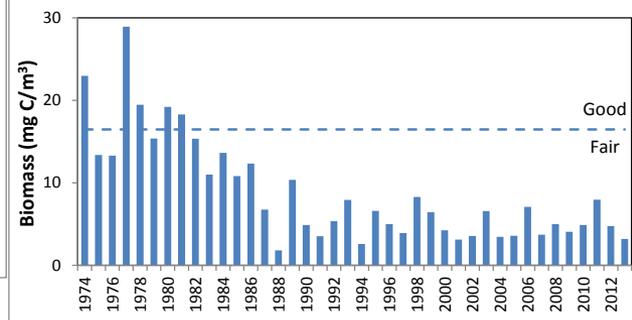
Copepod biomass



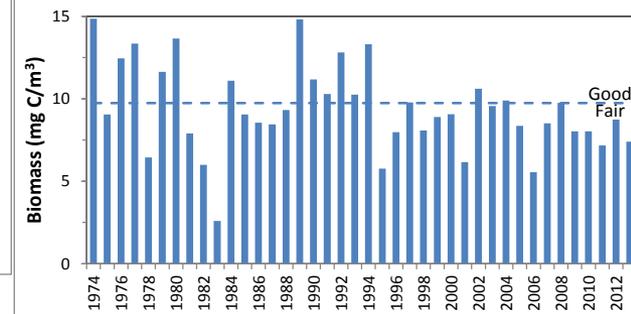
San Pablo Bay



Suisun

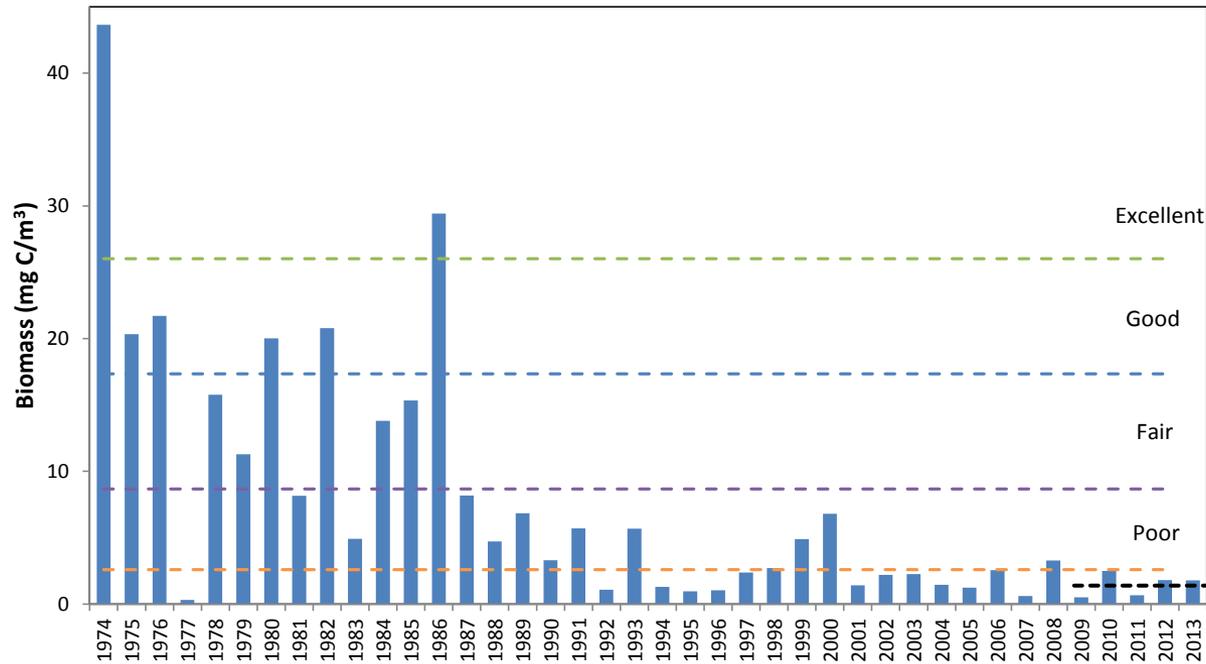


Delta



Benchmark – San Pablo Bay: ave. 1998-2002; Suisun & Delta: ave. 1974-1986

Suisun Mysid Biomass



Benchmark 1974-1986
average 17.34- “good”

2009-2013 average 1.45-
“very poor”

Summary of Zooplankton Indicator



- **Suisun** region - the largest decline in biomass of both mysids and copepods.
- *Potamocorbula* (invasive clam) has been implicated in these declines through competition for food and predation of copepod nauplii.
- The decline in food resources in the Suisun region is particularly concerning, as this region is important habitat for Delta Smelt and Longfin Smelt which utilize both copepods and mysids for food.
- **Delta** region - Mysid biomass has declined sharply; copepod biomass has remained “fair”.
- San Pablo Bay - Mysid and copepod biomass show a slight increasing trend, but the much shorter period of record in this region makes it difficult to compare to the other regions. Impossible to say if this trend would be the same if we had a longer period of record in this region.

Delta Food Web: Benthic Invertebrates



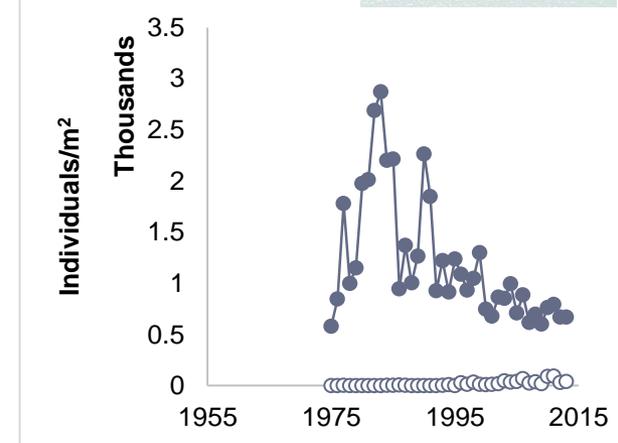
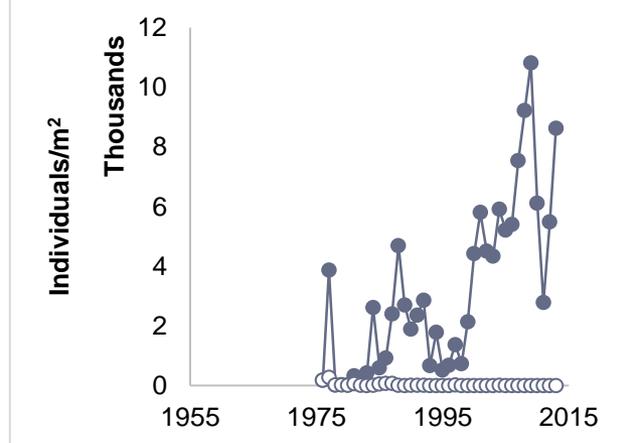
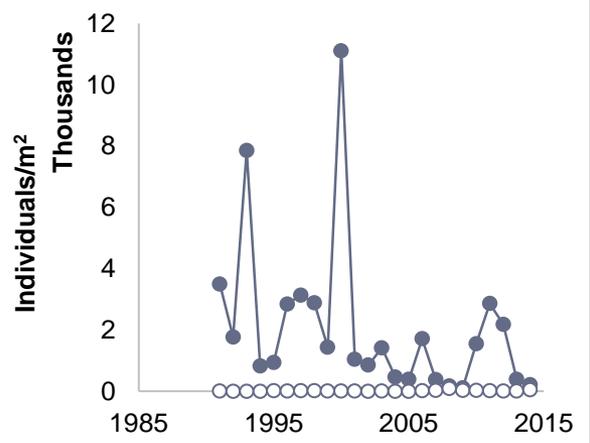
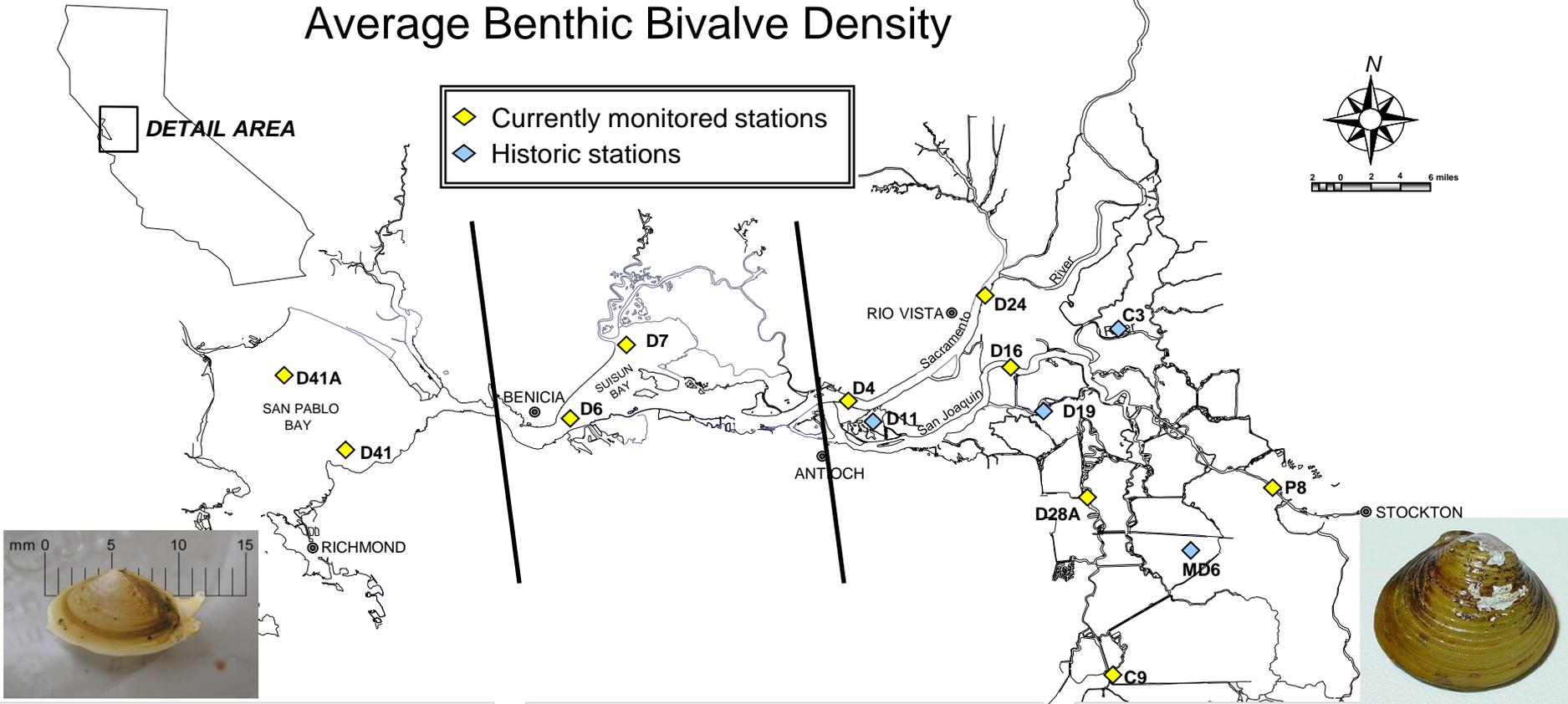
Author:

Betsy Wells, DWR

Peer input:

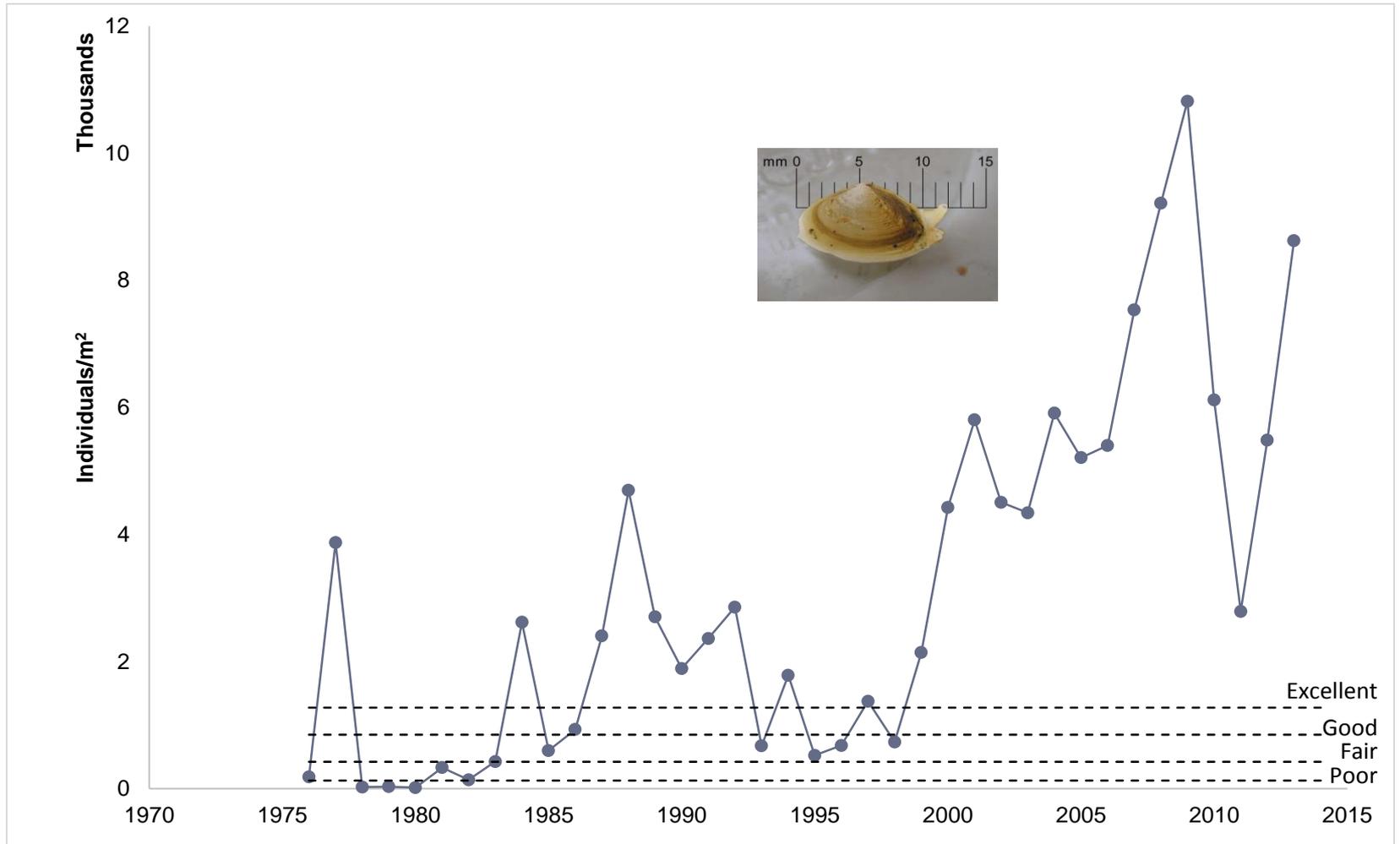
April Hennessy (CDFW), Tina Swanson (NRDC),
Shaun Phillippart (DWR), Wim Kimmerer (SFSU).

Average Benthic Bivalve Density

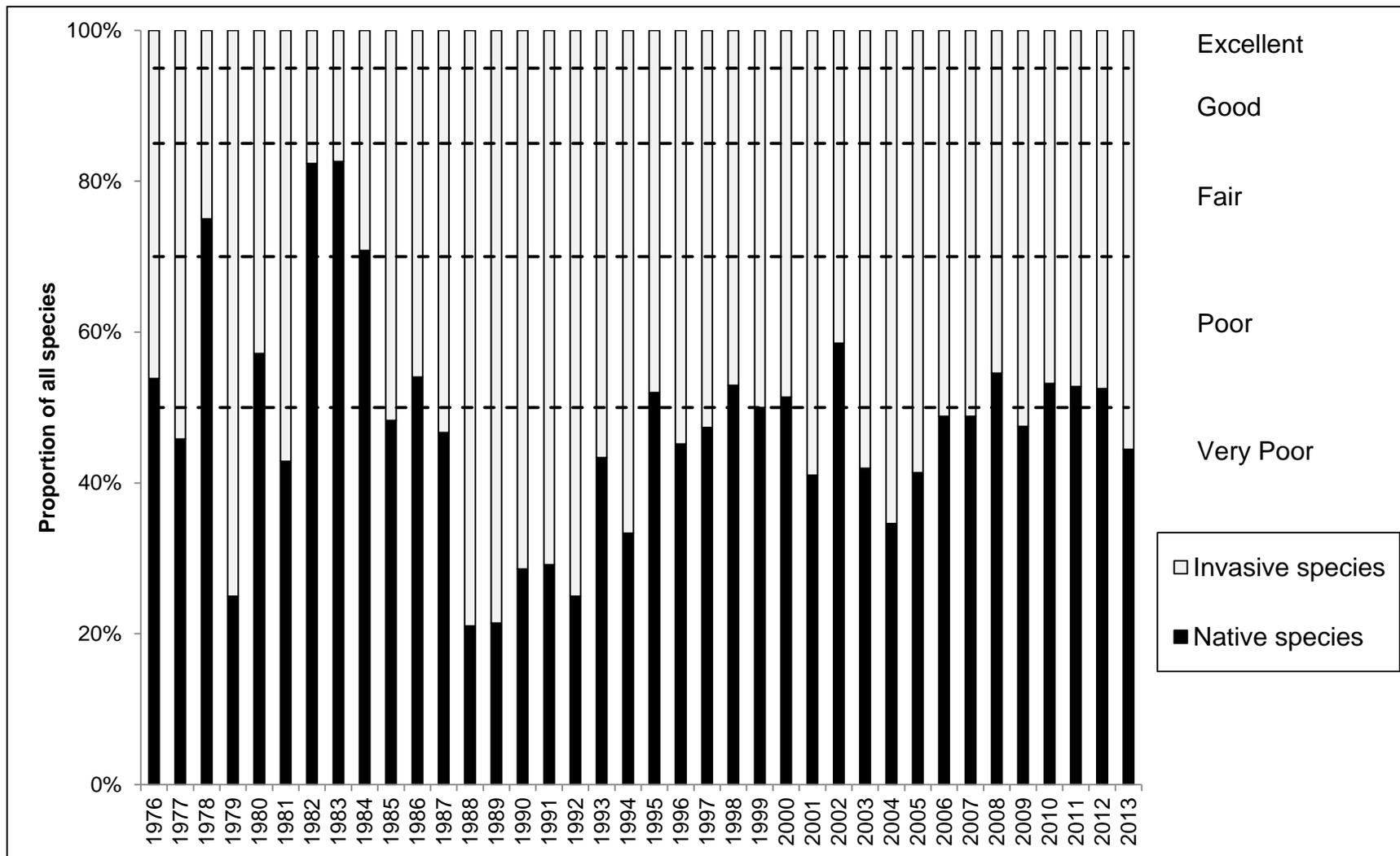


● Total bivalve density ○ Native bivalve density

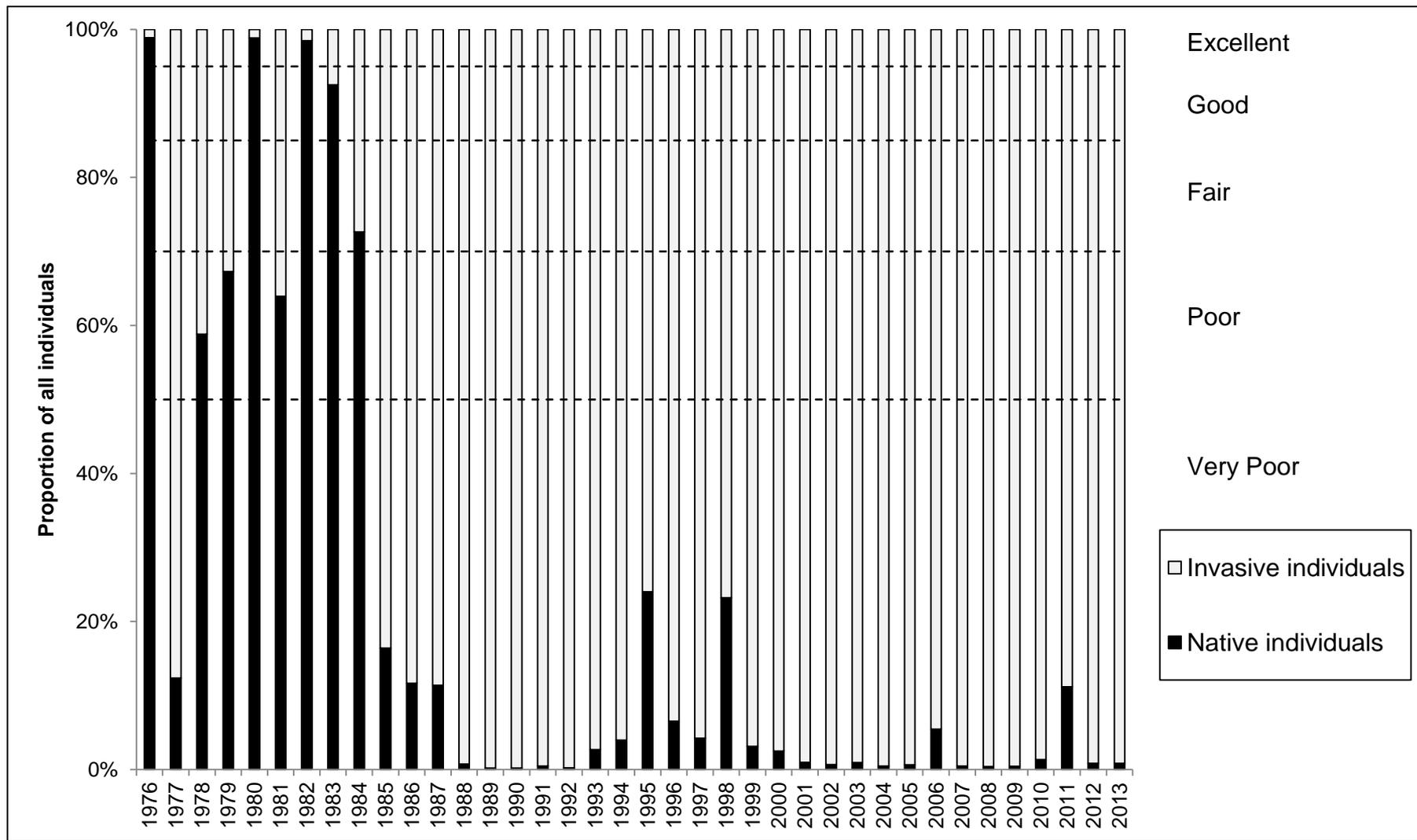
Suisun Bay total bivalve density



Benthic community composition by species – Percent Native vs Nonnative Invasive Suisun Bay



Benthic community composition by individuals – Percent Native vs Nonnative Invasive Suisun Bay



Summary of Benthic Indicator



- Total and native densities are slightly down from historical levels for several taxa-region combinations, but are still “Fair” overall.
- Native diversity as a percentage of total possible diversity has increased over time in all regions. The overall “Poor” grade could be an effect of the shifting nature of the estuary, especially in San Pablo and Suisun Bay, where you have a large number of total possible species but depending on water year would only expect to see a subset.
- There are more non-native species (“Poor” overall), and far more non-native individuals (“Very Poor” overall), than we would expect in a healthy estuary. This is especially true in Suisun Bay following the invasion of *Potamocorbula*. The Delta is better off than the other two regions, but is still not in great shape.

Next steps



- Continue with peer input process for indicators
- Finalize indicator summary information & technical appendices.
- Identify ways to integrate indicators with existing content on Estuaries Portal.
- Create new Portal content based on indicator methods (details next slides).
- Include additional datasets on Portal, e.g. FMWT, Zooplankton, Breeding Waterfowl.
- Using Indicators to Integrate Estuaries Portal with other Portals, particularly Wetlands & Streams Portals.

Proposed new Estuaries Portal content.

Example: USFWS Juvenile Fish Program.

- Data visualizations, overlays with driver data, e.g. turbidity
- User selected date / date ranges
- User selected station data
- Mean monthly & yearly catch per unit effort, by species, region-wide and sub-areas (shown next slide)

Delta Juvenile Fish Monitoring Program

JERSEY POINT - NORTH LANE

Summary Station Data Graph Meta Data

USGS | Lat: 38.052000 | Lon: -121.699000 | Elev: 10

CPUE: 55

Station Sensors: METHOD, VOLUME, DISSOLVED OXY, WATER TEMP, TURBIDITY, CONDUCTIVITY

Time: Thu Dec 04 2014 11:30:06 GMT-0800 (Pacific Standard Time)

DOWNLOAD TIME SERIES DATA

Updated 12/4/2014 13:24

UnMap Add to Favorites Zoom to Station

Turbidity (ntu) DATA VISUALIZATION: 7 DAY DURATION

Dec 4, 2014 12:30PM

Start Date: 2014-11-28 End Date: 2014-12-04 Duration: 7 Days Timestep: 1 hour

WATER, DISSOLVED OXYGEN ANH

Select an area by dragging across the lower chart

28. Nov 29. Nov 30. Nov 1. Dec 2. Dec 3. Dec 4. Dec

JERSEY POINT - NORTH LANE 12/5/14

Summary Station Data Graph SPECIES

Daily CPUE of fish (all species) sampled at Chippis Island (MWT),

n = 98

Updated 12/4/2014 13:24

UnMap Add to Favorites Zoom to Station

AVERAGE CATCHES ACROSS THE FULL EFFORT FOR 12/5/14

STATION	CATCH
American River	
Antioch Dunes	
B&W Marina	
Berkeley (Frontage Rd)	
Big Beach	
Brannan Island	
China Camp	
Clarksburg	
Colusa St. Park	
Cruiser Haven	
Dad's Point	
Discovery Park	
Elkhorn	
Garcia Bend	
Georgiana Slough	
Isleton	

USGS | Department of Water Resources | CALIFORNIA DATA EXCHANGE CENTER

DATA SOURCES

Proposed Estuary Portal Visualizations (USFWS Juvenile Fish Program – Seine net data)

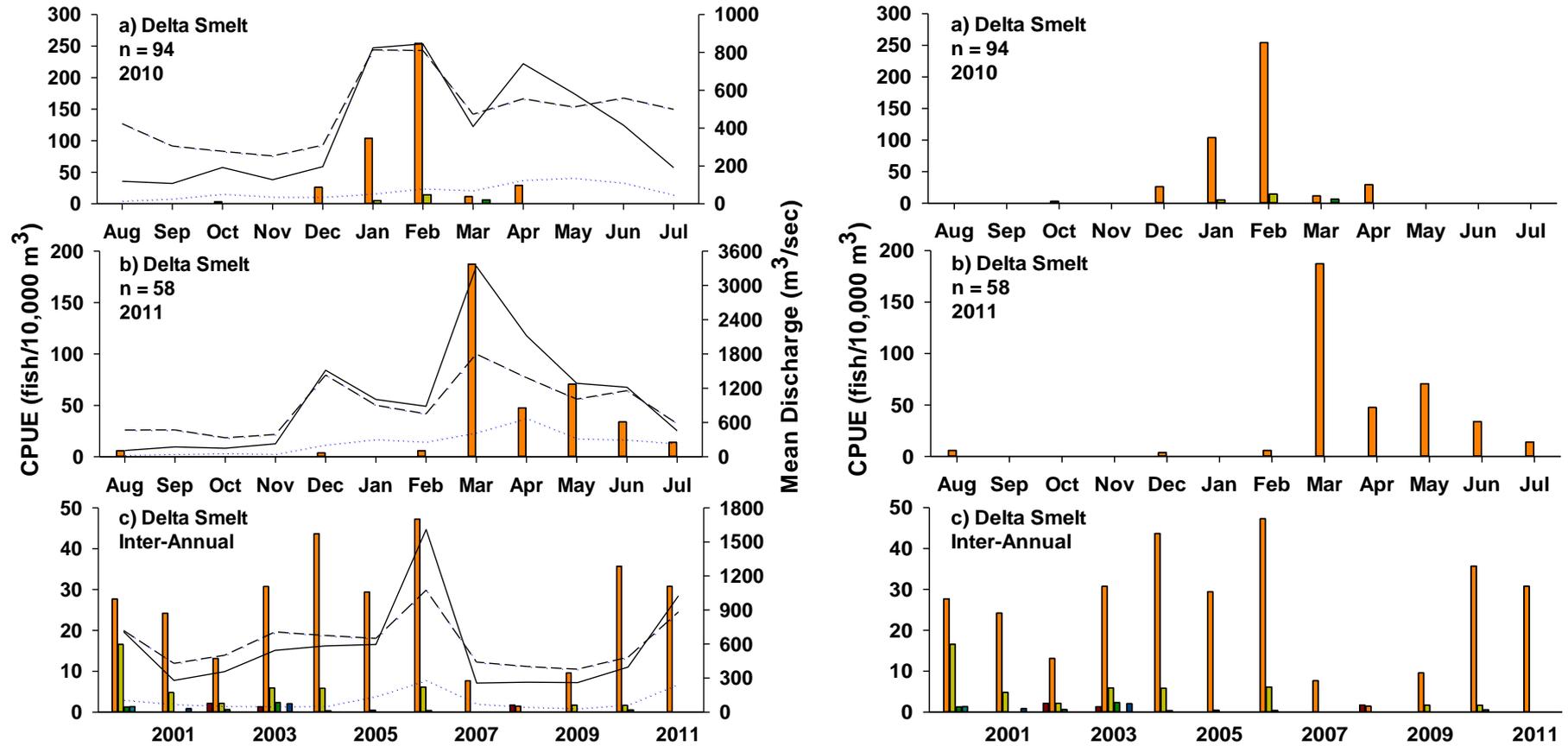


Fig 2. Mean monthly and yearly CPUE of Delta Smelt sampled in beach seines (Regions 1–6) during 2010, 2011, and 2000 through 2011. Sacramento River (Freeport), San Joaquin River (Vernalis) and Delta outflow (mean discharge) are shown on the left panel.